Hydrological Context for Holden and Eberswalde Craters:
A Study of Erythraea Fossa

Fans in the West Basin of Erythraea Fossa

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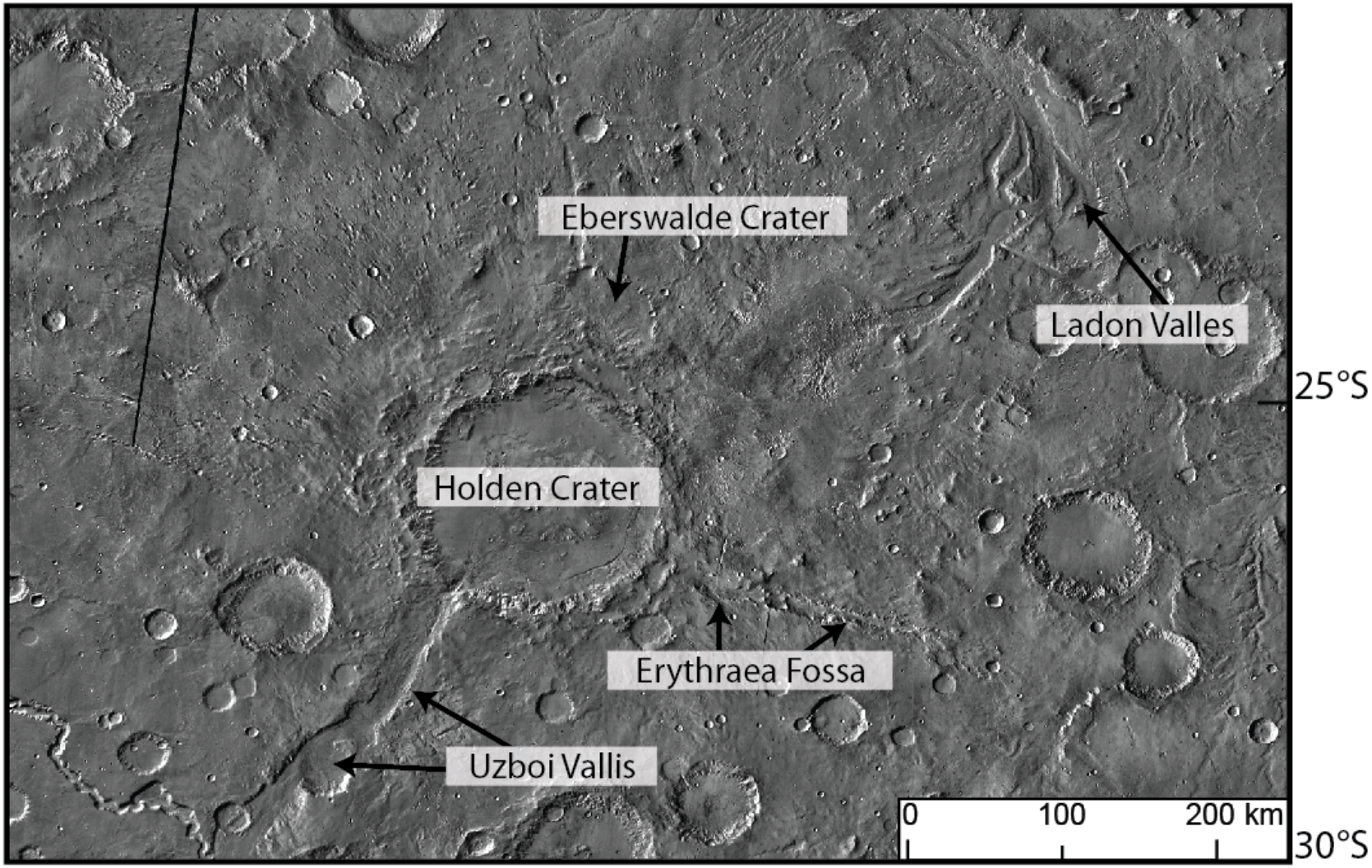
California Institute of Technology

Location

Erythraea Fossa is tens of kilometers from Holden; ~100 km from Eberswalde



THEMIS Mosaic

Holden and Eberswalde

Points of Interest, Abridged

Holden Crater

- Layered & Fan Deposits
  - Light-toned Deposits
  - Alluvial Fans
- Uzboi Breaches
- Bajada Surfaces
- Phyllosilicates
- Bedrock Outcrops
- Megabreccia

Eberswalde Crater

- Deltas
  - Sub-aerial
  - Sub-aqueous
- Lacustrine Sediments
- Phyllosilicates
- Inverted Channels
- Possible Holden Ejecta?

Holden and Eberswalde

Mission Objectives

Diversity

- Fan Deposits
- Exhumed Bedrock

Preservation

- Fans
- Channels
- Layered Deposits

Habitability

- Lacustrine Environment
- Low Energy Deposition

Context

- Good Timing Constraints
- Hydrology
- Basement Exhumed Via Impact

Erythraea Fossa gives further context to Holden and Eberswalde sites.

The Holden and Eberswalde sites will give insight into the surrounding region.

Erythraea Fossa

Regional Stratigraphy

Youngest

Preserved Hydrological Activity in Erythraea Fossa

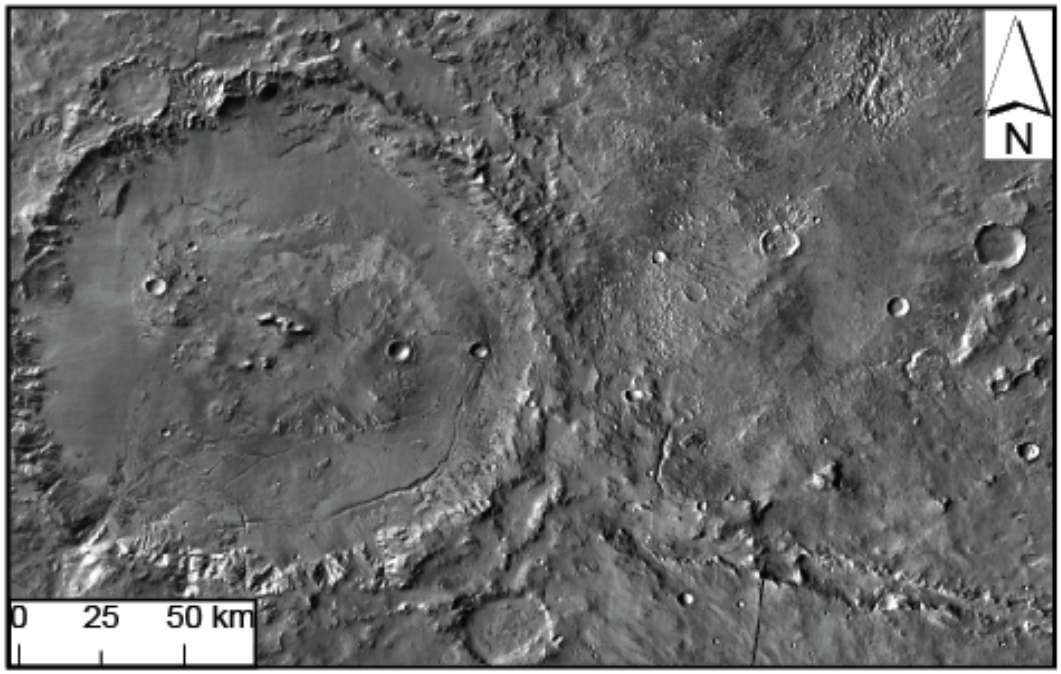
Hydrological activity in Holden/Eberswalde

Holden Crater-Forming Impact Event

Oldest

Erythraea Fossa Graben Forming Event

Eberswalde Crater-Forming Impact Event

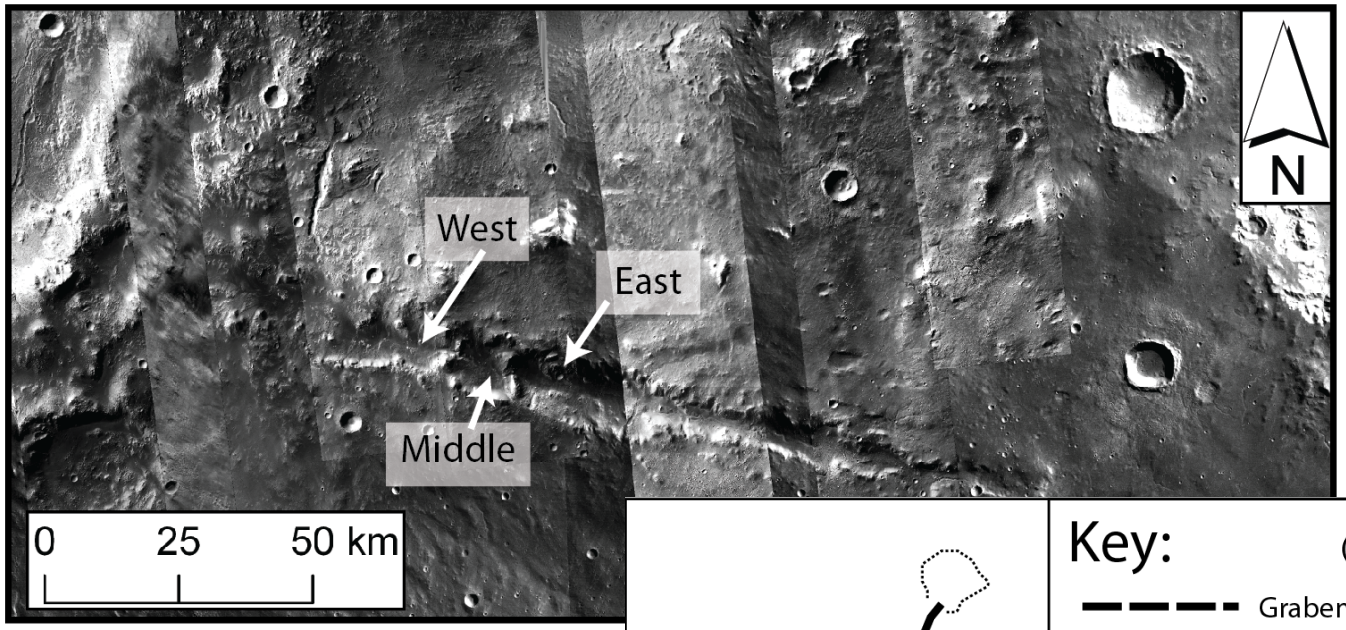


Holden superposed on Erythraea Fossa

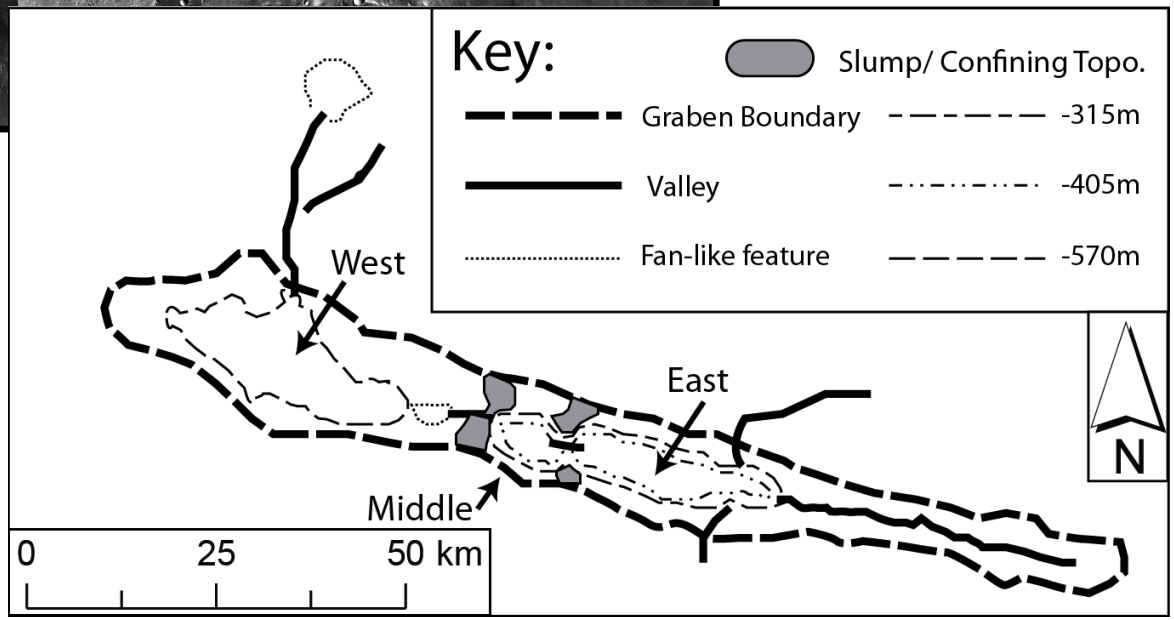
Due to its proximity, the Holden crater-forming impact would likely have destroyed any signs of prior fluvial activity.

Erythraea Fossa

Evidence for Paleolakes

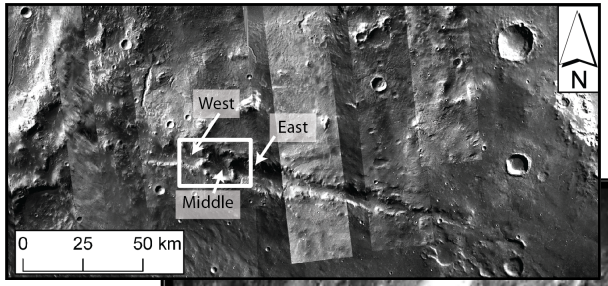


- Three Basins
  - Closed Contours
  - Breached by Valley
- Connected Via Valleys
- Capacity for 55.8 km^3
- Fans

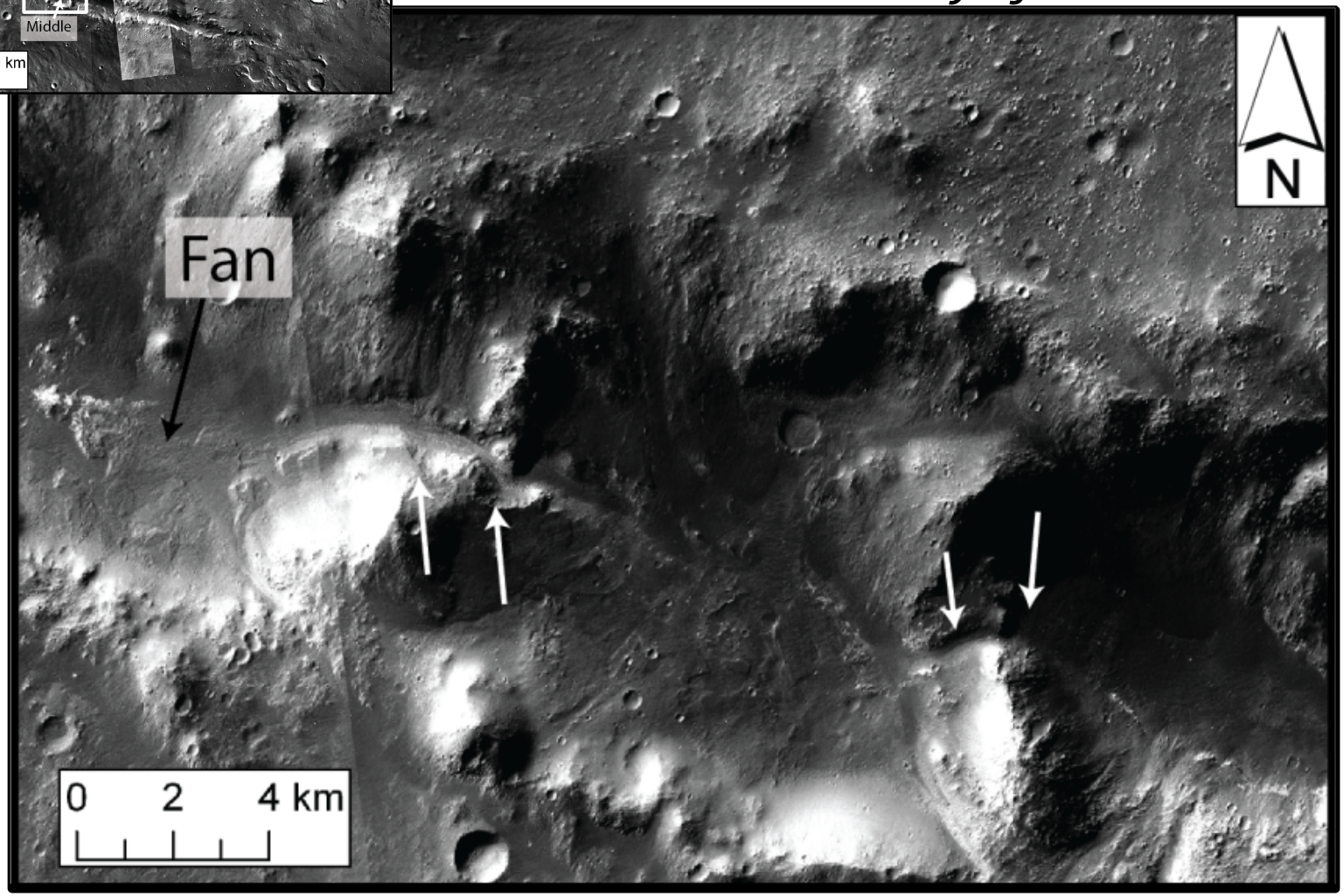


Erythraea Fossa

Evidence for Paleolakes

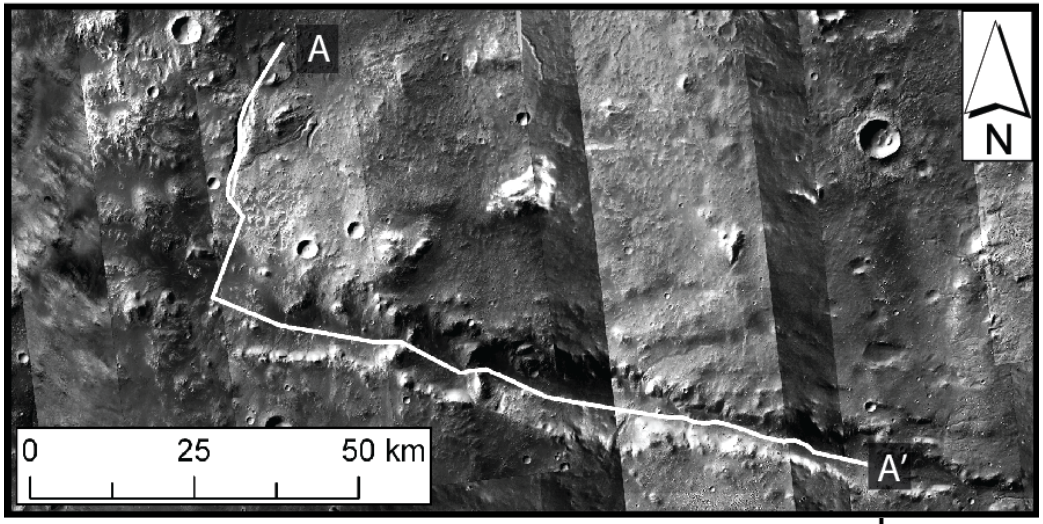


Inlet and Outlet Valley of Middle Basin



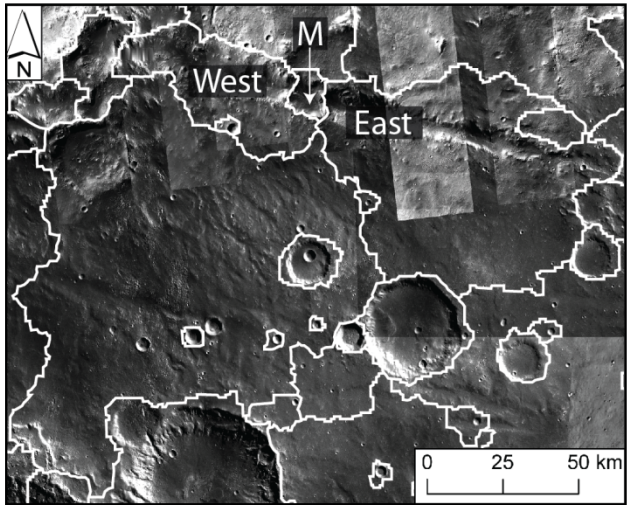
Erythraea Fossa

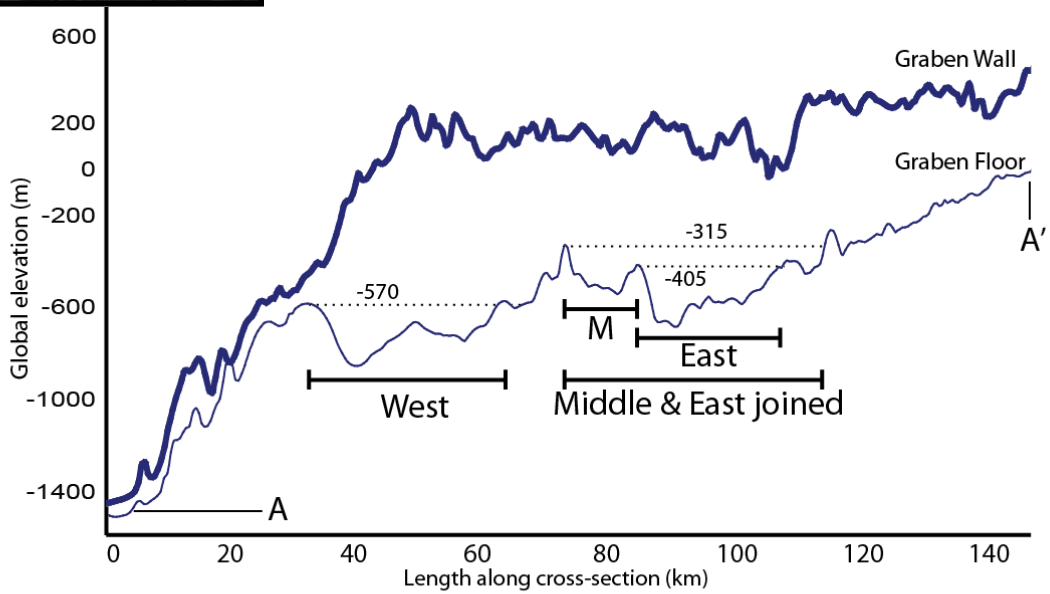
Evidence for Paleolakes



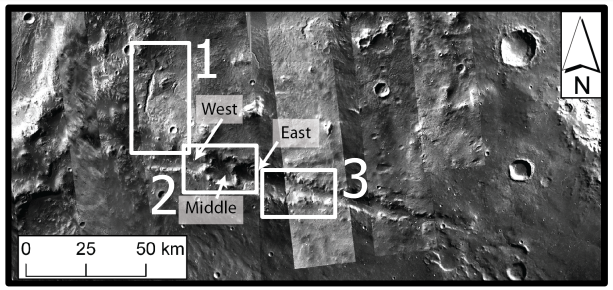
- Valley Slopes into East Basin
- East Basin Breaches into Middle Basin (joining)
- Middle Basin Breaches into West Basin
- West Basin Breaches, Valley Leads to Fan

Watershed



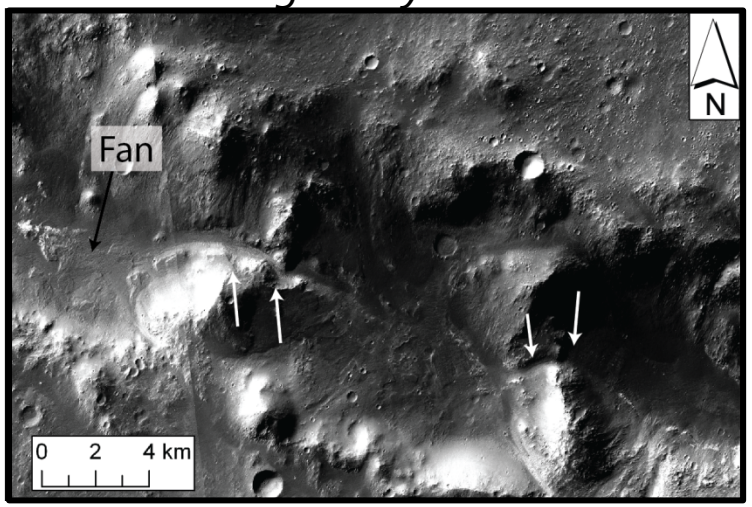


Erythraea Fossa

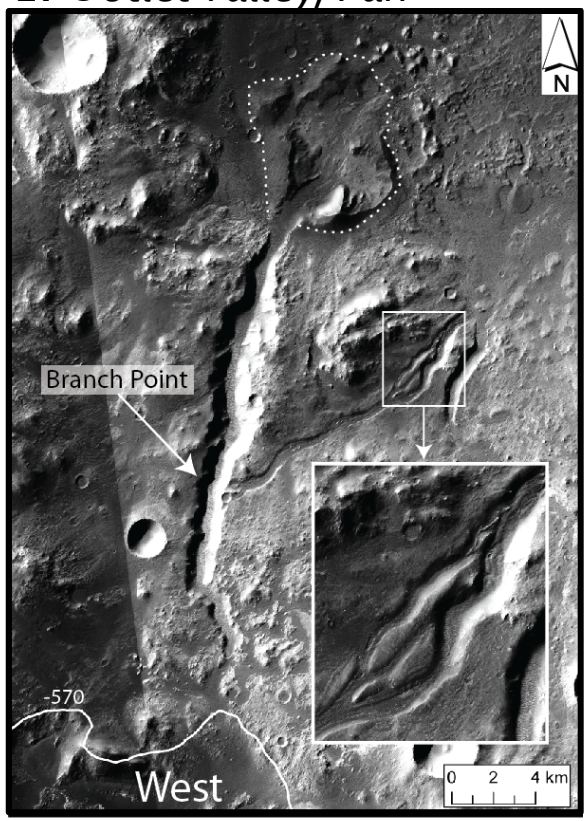


Evidence for Paleolakes

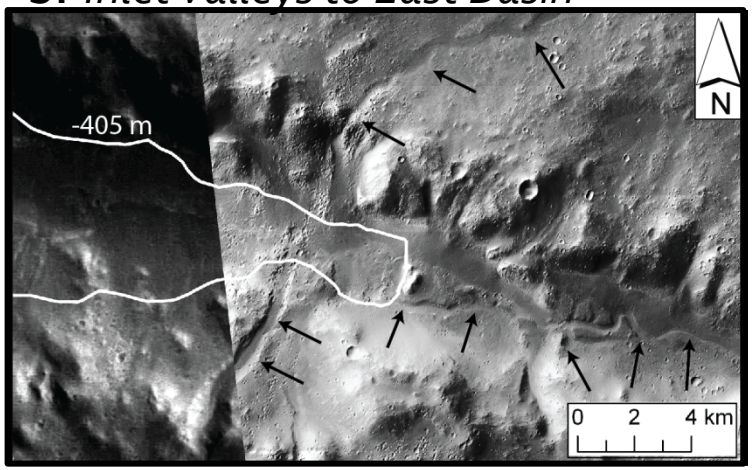
2. *Connecting Valleys*



1. *Outlet Valley, Fan*



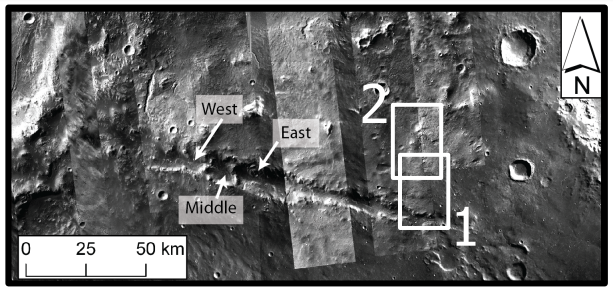
3. *Inlet Valleys to East Basin*



Valleys

- Sinuous
- Monotonic
- Inner Channels
- Branching
- Breach Point from Basins

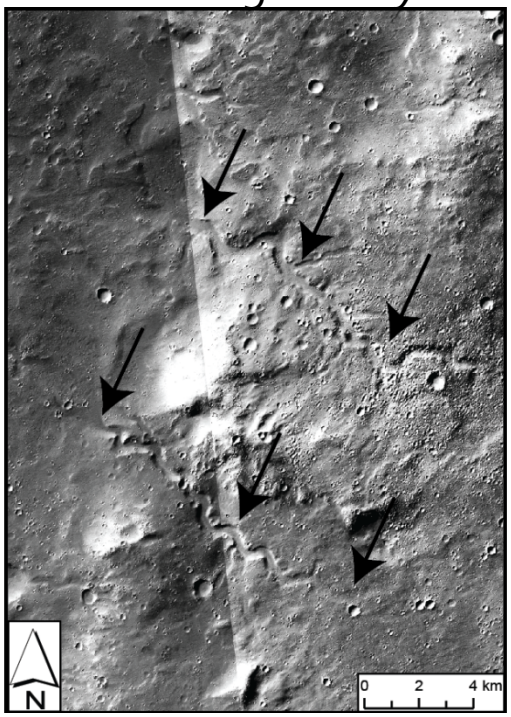
Erythraea Fossa



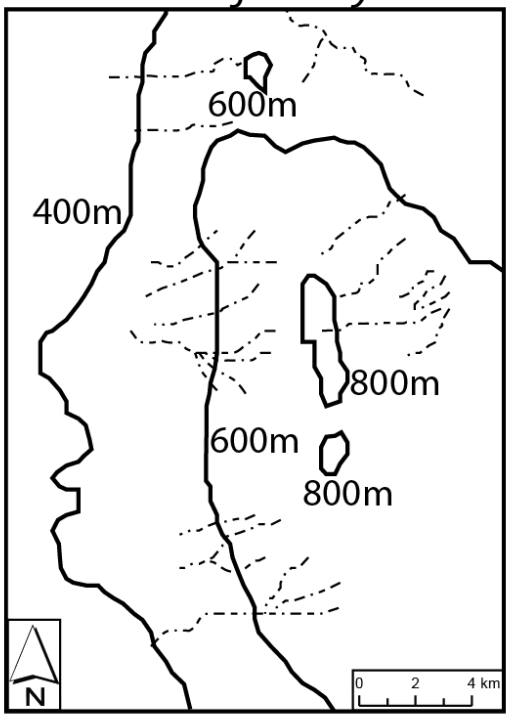
Evidence for Precipitation

1. *Dense High Valleys*

2. *Wider High Valleys*



1. *Sketch of Valleys*



Key: Contour Lines
Valleys

- Valleys beginning at high elevation
- Some begin at/near elevation maxima
- Begin at drainage divides
- These are evidence of precipitation

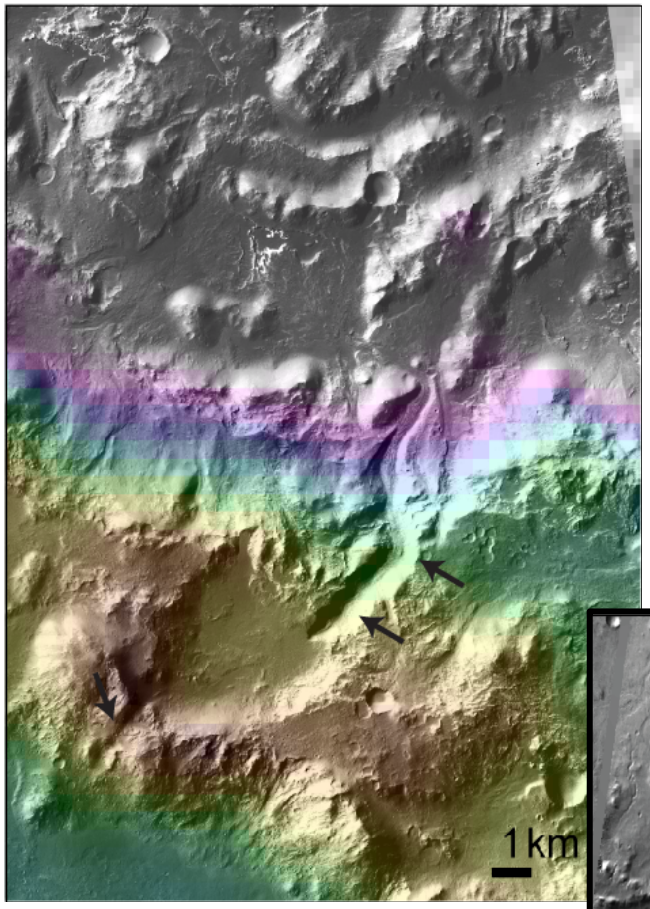
Holden and Eberswalde

Regional Hydrology

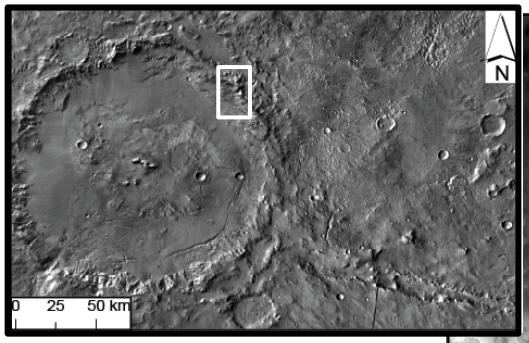
Proximity

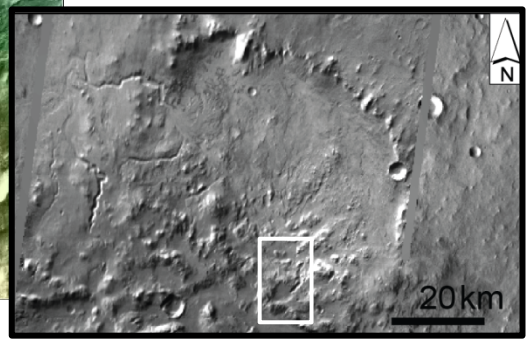
Holden and Eberswalde also likely modified by precipitation

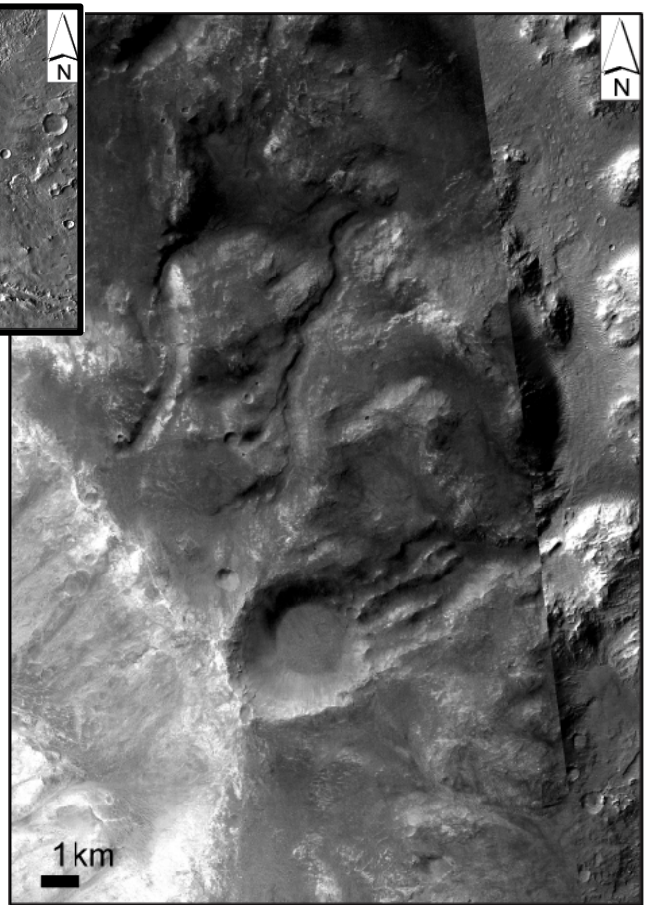
Tens to ~100 km away from Erythraea Fossa



High Valleys in Eberswalde

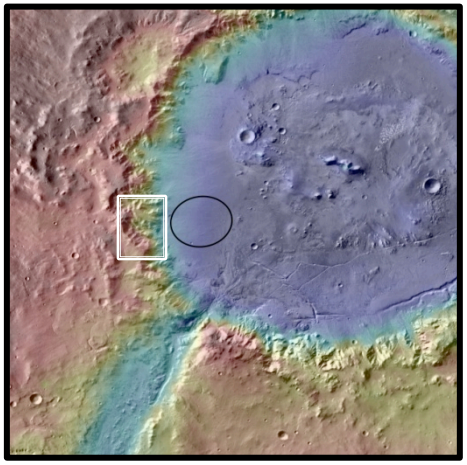






High Valleys in Holden

Holden and Eberswalde



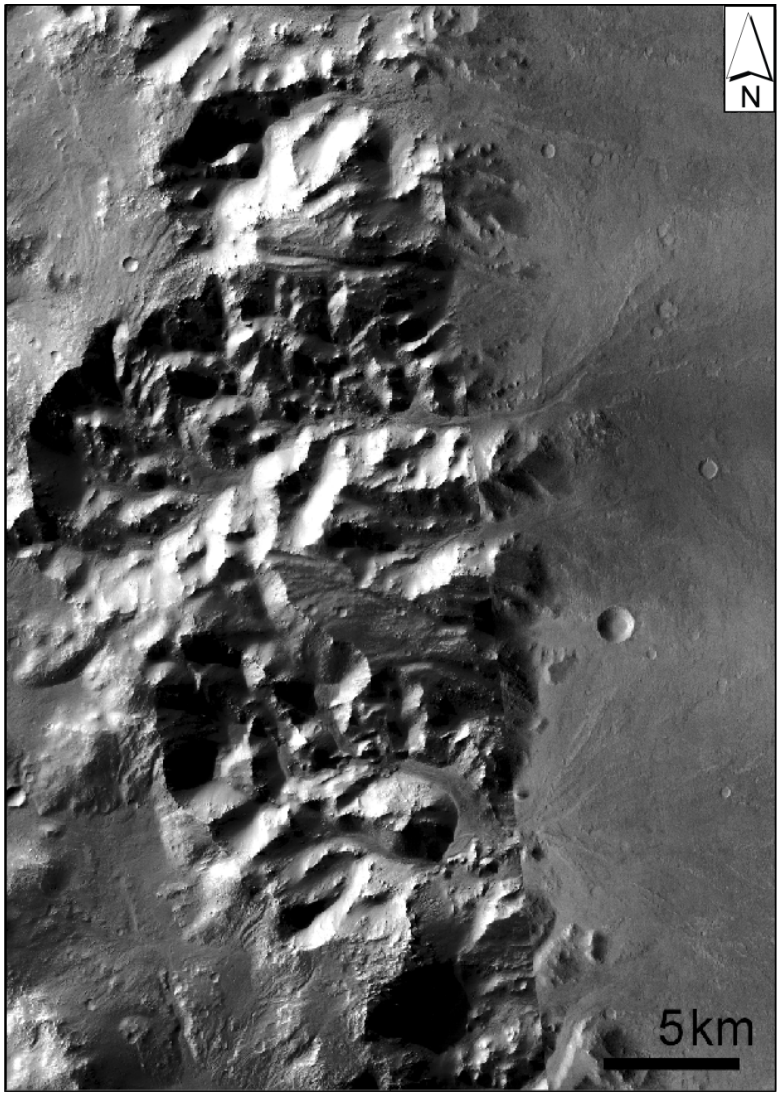
Landing Ellipse, USGS

Hydrological Record

- Sedimentary history of Martian climate
- Insight into broader Margaritifer region
- Know grain sizes

- *Holden and Eberswalde are not just markers of flood events.*
- *They also shed light on history of regional, more protracted, hydrology.*

Regional Hydrology



The Margaritifer Region

Conclusion

Erythraea Fossa

- Evidence for protracted, widespread hydrology
- Just one of many such signs in the Margaritifer Quadrangle

Holden and Eberswalde

- Contextualized Hydrology
- Insights into:
  - Valley Networks
  - Other Paleolakes
  - Timing (and timescales)

Not Only Hydrological History

- Exhumed material from impacts can give information about the early southern highlands.